TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE 13M 12JA)

ECE 2311: SOIL MECHANICS II

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *Pocket Calculator*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
Use neat, large and well labeled diagrams where required
This paper consists of **THREE** printed pages

Question One

a) Outline the assumptions considered when computing stresses using Boussinesq's formula **(5 marks)**

b) Determine, by Cullman's method, the critical height of an embarkment having slope angle of 40^o and $\phi = 20^o$ the constructed soil having C' = 630kg/m^2, and effective unit weight = 114kg/m^3, compute the $F_C = F\phi = 1.25$ allowable height of the embarkment if **(8 marks)**

c) A concentrated load of 1000KN is applied at the ground surface. Compute the vertical pressure:
   (i) At a depth of 6m below the load
   (ii) At a distance of 4m at the same depth **(4 marks)**

d) Using illustrations, briefly discuss the important factors that can cause instability and lead to slope failure. **(5 marks)**

e) Compute the shearing strength of soil along a horizontal plane at a depth of 6m in a deposit of sand having the following properties;- angle of internal friction $\phi' = 35^o$, dry unit weight d = 17KN/m^3 and a specific gravity G = 2.7. Assume the groundwater table is at a depth of 3m below ground surface. Also find the change in shear strength when the water table rises to the ground surface **(8 marks)**

Question Two

a) ABCD is a raft foundation of a multi-storey building wherein AB = 22m and BC = 10m. The uniformly distributed load q over the raft is 750KN/m^2. Determine δ_z at a depth of 6m below point O, wherein AA$_1$ = 4m and A$_1$0 = 6m (Use chart II) **(10 marks)**

b) Define soil stabilization and briefly highlight the various types of admixtures used in sol stabilization. **(10 marks)**

Question Three

a) With the aid of sketches, discuss the different types of circular surfaces failure **(10 marks)**

b) Determine the factor of safety of a slope of infinite extent having slope angle = 25°. The slope is made of cohesionless soil with $\phi = 30^o$ **(2 marks)**

c) Analyze the same slope if it is made of clay having $C' = 30KN/m^2$ $\phi' m = 20^o, e = 0.65$ and Gs = 2.7; under the following conditions:
   (i) When the soil is dry **(4 marks)**
   (ii) When water seeps parallel to the surface of slope **(2 marks)**
   (iii) When the slope is submerged **(2 marks)**

Question Four

a) Two footings of size 4 x 4m and 3m x 3m are placed 9m centre to centre apart at the same level and carry loads of 150kg and 120kg respectively. Compute the vertical pressure at a depth of 4m at point C midway between the centres of the footings. **(10 marks)**

b) Explain the following soil mechanics terms:
   (i) Angle of obliquity
   (ii) Principal plane
   (iii) Shear strength
   (iv) Cohesion **(4 marks)**

c) Outline the shearing characteristics of a soil **(6 marks)**

Question Five

a) Compute the factors of safety:
   I. With respect to strength
   II. With respect to cohesion

III. With respect to friction for a soil whose shearing strength parameters are; C' = 26.7KN/m^2, $\phi = 15^o$, $C'm = 17.8KN/m^2$ $\phi'm = 12^o$ and The average intergranular pressure σ of the failure surface is 102.5KN/m^2. What happens when:

(i) Factor of safety with respect to cohesion is unity?

(ii) Factor of safety with respect to friction is unity? **(10 marks)**

b) Briefly discuss the THREE parts to an analysis of the stability of a slope **(10 marks)**